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AMERICAN FOUNDRYMEN'S

ASSOCIATION.

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The American Foundrymen's Association is not responsible for any statement or opinion that may be advanced by any contributor to this Journal.

PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on Wednesday evening, June 2, with President Wanner in the chair. Secretary Evans read the following report of the Executive Committee:

REPORT OF EXECUTIVE COMMITTEE.

"The Executive Committee have very little to say on the subject of the foundry trade. We have made so many prognostications and have failed so utterly that the less we can say probably the better. In January we made a statement that by the first of June the shops would be full of work. The first of June has arrived on schedule time, but we do not find the shops full of work, as a rule. There are some few foundries that are busy on specialties, and some have sufficient export trade to keep their cupolas running to their capacity, but the foundry that has to go into the market and pick up trade has a hard row to hoe and it finds but little work at very low figures, which is, to say the least, exceedingly unsatisfactory. However, we are now impressed with the idea that the worst is over and that there is a gradual change for the better. The large convention which is being held in this city during this week by the Manufacturers' Club and the Philadel-

phia Museum may have an important effect upon trade in general, particularly trade with South and Central America and Mexico and other foreign countries. This will be one of the greatest conventions that has met in Philadelphia for years, looking entirely to the interest of the manufacturer and to the improvement of our export trade. The National Association of Manufacturers, under the presidency of Mr. Search, is about opening a permanent exhibition in Venezuela, where samples of American manufactures will be placed under the care of attendants who will look after the interest of the exhibitor. Thus all lines are being looked after with a view to building up business out of the depressed condition of affairs that we have had during the last several years. We cannot help but think that the time is not far distant when we will find ourselves again in prosperous condition."

The Treasurer reported $1,508.61 in bank to the Association's credit.

Mr. Evans then called upon the various members present for expressions of opinion on the business outlook.

Mr. Fitch, of Hanover, Pa., said that his firm was busy, but that trade was dropping off again.

Mr. Oliphant, of the Trenton Malleable Iron Co., said: "Business is about the same as it was last month, and not so good as during February and March. It is better, however, than during the corresponding period of last year. Prices are a little lower than usual, but the promises of trade during the next three months will be realized."

Mr. Ellicott, Southwark Foundry and Machine Co.: "We are still in a very flourishing condition—better than at any time during the eight or nine months past. The volume of business is increased. We are still working on the order for Russia, which I reported to you several meetings ago, and we are working hard to get the job done on time."

George Rocket, Morris, Tasker & Co., Philadelphia: "Business is very dull and has been so for the last month."

Mr. Harkins, of T. B. Harkins Foundry Co., Bristol, Pa.: "Not much improvement in our neighborhood."

Mr. Williams, of Enterprise Mfg. Co., Philadelphia: "We have been working five days a week, but we have hopes of doing better than that. The general trade has advanced during the last month. We have increased our foundry force, and prices are good, only because we have a standard price for our specialties, and will not go below it."

Mr. McClure, Hooks Smelting Co., Philadelphia: "We expect more business soon. Orders are coming in slowly. As the iron men pick up, we will find improved conditions in our brass foundry."

President Wanner, representing the cast-iron pipe section, said: "I still feel as I felt at the last meeting in regard to the effect of tariff agitation upon trade conditions. If we are to have a July meeting I think it should be devoted to the consideration of this evil, which is holding back prosperity. The pipe trade, so far as I can see, is still in a deplorable condition. It is exceedingly annoying to me to see, whenever there is a little bit of letting, nearly all the pipe founders from all over the country competing. In many cases I refuse to bid just to show that somebody has the backbone to stand back and let others do the scrambling. If this keeps up, it will show that there are a great many more pipe foundries in the country than are needed. That, however, I cannot believe. A general revival will boom the pipe trade, fair prices will be realized, and there will be enough to keep all busy. Prices should have been kept up all along instead of resorting to cutting. It was possible, for they never got so low as this, even during the crisis of 1888. We want more pluck and courage. I hope that when we meet again, the tariff question will have been disposed of, and we will have prosperity."

A paper by Mr. S. S. Knight, chemist of the Addystone Pipe and Steel Co., Cincinnati, was then read. It is as follows:

"FLETCHER'S PROCESS OF MAKING CAST-IRON PIPE."

The cast iron foundry business, and particularly that part which has to do with pipe making, seems to have remained almost dormant for the past twenty years. By this statement is meant, not that all of the details of the pipe foundry business have been retained unchanged in all that period, but that no material or striking advance has been made since the vertical casting of pipe was inaugurated. How far reaching the benefits of this method were we should not forget, but although it greatly lessened the chance of loss from such defects as one-sidedness or lack of symmetry, it did not materially decrease the cost of production.

It should be remembered that in pipe making one of the greatest costs aside from the metal is the mold and the labor necessary to clean and render marketable the product. In the molding the chief cost is the making of the core and the maintaining of the barrel or core bar in working shape, especially for smaller pipe, such as 3, 4 and 6-inch. In the cost of the core we will first consider the materials used in its manufacture. By far the most costly of these is the hay rope, or loose hay, that is put on as the combustible layer. This is then covered with clay, and this in turn with the so-called first coat usually made of clay and dirt taken from the previous cores. The bar or barrel with this cover is now dried. It is then taken out and upon it is turned the last finish coating of sand, sawdust, and previously used core dirt, after which it is given a coat of blacking. The finished core is now dried. This core when used burns and vents well, but leaves the core dirt stuck fast to the interior of the pipe. Since so much clay is used in making the core, the dirt has to be in a large measure cut out and much labor is required to clean a pipe so made. The necessity of the pipe being clean and free from adhering dirt will be apparent when it is noted that a coating of tar paint has yet to be applied. The two objections to this process will be noted, viz the cost of the hay rope, which, on a 6-inch bar amounts to over five cents, and the labor required to clean pipe cast with such cores, due to the amount of clay used in their manufacture.

Among the recent improvements that have come forward in the pipe foundry business, none seems more deserving of consideration and use than that proposed by Dr. Fletcher, of Cincinnati, for making the cores just described. His invention was the result of patient labor extending over seven years, and although he met with pronounced successes, he did not stop until he had given to the trade a method simple, economical, and which masters both of the difficulties pointed out in the use of the old method.

Eearly in the nineties Dr. Fletcher began experimenting with a view of doing away with the hay rope used. To accomplish this, mixtures of combustible substances such as sawdust, leaves, etc., and earthy or mineral cements were made. The proportions were varied in every reasonable way with more or less success. But not until more recently did he conceive of his present method which at this time stands perfected in every detail. The method consists in mixing starch hydrated in water with sawdust, or any comminuted combustible material, and applying this to the bar or barrel directly by means of a wire gauze which passes under the bar and off, from one roll on to another, the two rolls being geared to the bar. A 2 per cent solution of starch is used and in practice this is mixed with an equal bulk of sawdust. About 25 per cent of this starch solution is saved by being squeezed out by the gauze and collected, and is again ready for use.

After the bar is covered with the sawdust mixture it is placed in the oven and dried, when it is ready for the first and only coat of dirt. This dirt is the same in composition as the last coating in the old process, and since it contains no clay it can be easily washed out of the pipe.

The cost of applying this process on a 6-inch bar is less than one cent or a saving of four cents on the combustible coating on a single bar. In this new process only one-half of the dirt usually used is required and the saving in labor in the cleaning shed amounts to fully one-half. But a virtue of no small importance is the increased size of the bars used on all small pipe, since this coating may be put on any thickness desired. This increased size

of the bars allows them to withstand rougher usage and materially prolong their life. Since no clay is used in the dirt core, the core is very porous and vents well. The gases forming near the molten iron escape back through the core, and thus the danger of blow holes in the iron is reduced to a minimum.

The paper was discussed by E. A. Kebler, of the Matthew Addy Company, Cincinnati, who said that the inventor of the process was a man of genius and might have discovered a process which would do what was claimed. In England, he said, they had done away with hay rope entirely and used collapsible bars, but with hay rope at present prices, compared with the expense of keeping up collapsible bars of different kinds, he thought hay rope still had the advantage in point of economy, unless Dr. Fletcher's process was found practicable.

Secretary Evans called the attention of the meeting to a new process in cupola practice being introduced as the Doherty process. The process was no more nor less than the introduction of a steam jet about opposite to each tuyere. A 1-inch pipe circled around the inside of the cupola, and a ¼-inch pipe running from the 1-inch pipe, with a nipple or tee on it, mixed steam with the blast. It was claimed that by the process the worst kind of scrap could be melted, and that the iron was softened by the process and made a very close casting. He said he had been in communication with Mr. Doherty, and had received a booklet on the subject of the process. He, the Secretary, had been of the opinion that he had heard of a similar process before, and on inquiry found that Mr. Carlton, of the Pratt & Whitney Company, had used steam in this way years ago, but for want of time for experiments gave the matter up.

Mr. Ellicott said he had heard of steam being introduced in the blast furnace but not in the cupola.

Mr. Williams reported that he had used a steam jet in an experimental way, but the difficulty he had experienced was in getting steam dry enough. He had met with success at times, but the supply of dry steam could not be maintained. Besides, he

did not believe that any scrap once burnt out, or even partially burnt out, could be restored to its original condition without adding to it other elements found in good iron, and which he did not believe the mere melting with a steam jet could create.

Geo. C. Davis, chemist to Thos. Devlin & Co., Philadelphia, then addressed the meeting:

"I have received several letters in regard to my paper, 'Notes on Malleable Cast Iron,' read before this association at the last meeting, and I take this opportunity to reply briefly. One correspondent writes: 'You say that silicon should be between 0.60 to 0.90 to obtain the best results. The majority of our customers ask for silicon from 1 to 1.25 rather than below 1 per cent.' Some use it as high as 2.50, but this, of course, is for melting with large amounts of sprue. This gentleman is speaking of pig iron, while my remarks applied to castings. Taking into consideration the oxidation of silicon in melting, our views coincide. My remarks as to sulphur in charcoal iron were based on analyses of representative lots of different brands made by well-known analysts. One charcoal iron company recently sent me a report of an analysis of a No. 1 iron made by seven different chemists. Six of them varied from 0.010 to 0.027, while a firm of public analysts here who are usually considered 'a court of last resort' in matters of the kind reported 0.017. A sample of No. 4 of the same brand as mentioned showed 0.023 according to one public analyst whose method included examination in soluble residue, while three technical chemists reported 0.017, 0.017 and 0.018 respectively on the same sample. Much of the discrepancy is due to difference in method, but we find that the best chemists do not confirm the low results for this class of iron."

The meeting then adjourned until the first Wednesday in September.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Pittsburg Foundrymen's Association was held in the Builders' Exchange, Pittsburg, Monday evening, June 28, with President Taylor in the chair.

Mr. Thomas D. West read a paper on the "Comparative Fusibility of Foundry Metals":

In the advance of founding to a basis of greater exactness and assurance of successful workings, it is often as essential for us to have information on the fusibility of the metals that we make mixtures from as to know the effect of one metalloid on another in changing the physical character of iron. This is realized when we consider how easily a formulated mixture can be prevented from giving calculated results by one metal having a lower fusing point than another when charged in a cupola.

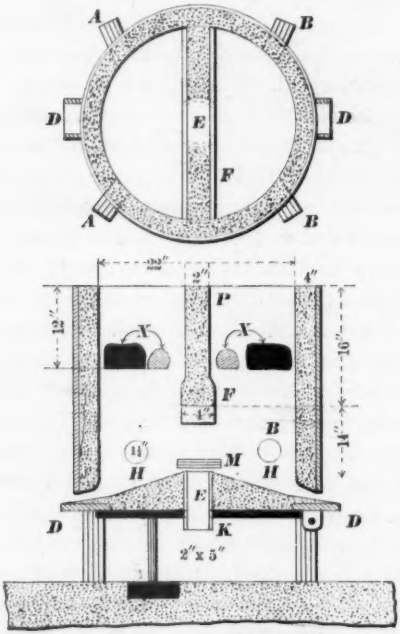
While this is a subject of importance to the general and heavy-work founder, who is often called upon to take several different grades out of a cupola at one "heat," it is also of importance to the specialty and light-work founder, who may be changing irons or may not have a correct analysis; for when he knows that one combination of certain metalloids requires greater heat than some others, he is in a much better position to decide whether it is the iron, atmosphere, blast, fuel, mischance, or his own mismanagement that makes the cupola irregular in its meltings, so that it produces "hot iron" one day and "dull iron" the next, with resulting bad work or heavy losses in castings.

Believing that it is often as much the particular combination of the metalloids as the physical character of the iron which causes grades of iron to differ in their fusibility, I decided to experiment to learn, if possible, the effect of different combinations of the metalloids on the fusing point of iron. In searching for appliances that would give reliable data I failed to find anything satisfactory, and therefore set to work to devise something that would meet the requirements and at the same time withstand criticism. One objection I have to past methods of test-

ing the fusibility of metals is the failure to provide conditions similar to those in actual founding. For example, I feel confident that the gases emanating from the fuel when combined with the blast have an effect upon the chemical constituents of metals. I have studied out the design of cupola illustrated, which is an original arrangement, so far as I know. The method adopted gives only comparative results and does not show the degree of heat required to fuse any of the metals. Observations may be made and conclusions derived from them as to the difference in the time of melting which any grade of metal requires over another, when the two kinds of iron are charged in the respective sides shown. It will appear on examination that like conditions prevail in both apartments, and that if one grade starts or comes down quicker than another, we know it to have a lower fusing point. By a series of such tests we are in position to formulate a scale, showing the combinations of metalloids requiring the highest heat, with the relative gradations of others down to that most readily fused, a table I am now laboring to complete.

The comparative test cupola shown is not an expensive affair and is such as might often be a valuable adjunct to the laboratory of metallurgists, blast furnaces, foundries, etc., besides being useful in the production of small castings, of one mixture, or any which it may be desirable to make of two separate grades of metal. As an example of what may be done in this line, I would call attention here to the casting before you, which is 2½x4x6 inches, one-half of which is cast of remelted steel and the other half of a high silicon or a very soft grade of cast iron. This cupola is also useful in other lines. For instance, the other day we found it necessary to have a much harder iron in replacing a worn out 36-inch worm gear wheel, than our regular run of specialty iron would give us. Instead of taking the chances of contaminating part of the regular heat with a foreign mixture, we put in the regular form of a straight slanting sand bottom leading down to one tap hole, in the comparative test cupola, Fig. 1, started the fire and charged on about 120 pounds of scrap steel and white pig iron (broken to small size) promiscuously in

both sides of the cupola. When all was ready, the blast was put on and in three taps we caught the metal in a hand ladle, pouring it into about 300 pounds of iron from the regular heat, which was held in a crane ladle standing in readiness for its reception. The time of this heat was about ten minutes from the putting on of the blast. The value of this to founders who occasionally, or



"WEST'S COMPARATIVE FUSION TEST CUPOLA."

even at every heat, may want a few castings possessing a harder mixture or a softer one than the regular heat needs no comment.

In designing this cupola I arranged for a center blast, besides having outside tuyeres on the plan shown. This permits of the greatest possible uniformity of combustion throughout the area of the cupola and affords every opportunity of regulation should the heat, from any cause, be greater in any one portion

than in another. This regulation is secured by diminishing or increasing the volume of blast by valves attached to branch pipes, not shown, leading to the tuyere openings A A, B B and E. It may be asked, How is it possible to know when there is perfect uniformity of heat all over the cupola area? This is indicated by the color of the flame emanating from the open top of the cupola. If any difference should exist there, in the top area of either side, the eye will detect it as quickly as the steel maker can note changes taking place in a Bessemer converter by means of the spectroscope.

In operating this cupola the sand bed is put in with two slanting bottoms, as seen at H H, thus preventing either metal, as it comes down, from mingling with the other. The center tuyere has three pieces of ½-inch round iron laid over its opening, as seen at M, to prevent the fuel from dropping into it and stopping its blast passage. Good kindling is used up to within, say, 12 inches of the top. On this coke broken to egg size is then placed. The coke is poked down as the fire burns until there is a solid bed of live coals up to within 12 inches of the top. If the metal to be fused is of a light character, or easily melted, it is then charged at this height; but if it is heavy or hard to liquefy, then the bed of live fuel should extend up to about 9 inches of the top. As this cupola has ample tuyere area evenly divided, it will be found to work best with what would be termed a "mild blast." The blast is started slowly, increasing the volume gradually for the first two minutes until all the force advisable is on. The tap holes at D D are left open so as to permit the metal to flow out as fast as it melts, thus allowing a record to be made of the metal's first and last appearance. Of course, should the cupola be used simply for the purpose of melting to get metal to pour a casting, it could be then stopped and tapped the same as any cupola used in ordinary practice. If the cupola is employed for testing the comparative fusibility of metals, it will require about six men to operate it—one for timekeeper, one to charge on fuel evenly and poke it down, so as to preserve a solid fire until the iron is about half down; one at each tap hole to keep it open that the metal

may flow freely; and then, if the metal is to be caught into molds, one man on each side to take away the filled molds and replace empty ones. If the cupola is only to be used to obtain metal to pour a small casting, or to record the time of fusing by letting the metal down into a "pig" as it comes out, then two men are sufficient to operate it. In charging any metal for a comparative test, care must be exercised to have the "bed" of fuel the same height on both sides, also to have each grade of metal as near uniform in size as possible, and evenly charged. After this, coke is filled in until the cupola is stocked to its brim, when it is ready for the blast.

The first test heat we made, as seen by Table 1, consisted of 150 pounds on each side, it being put in with 50 pounds in two charges after the "bed" of 50 pounds was on. This plan was found to be objectionable for comparative testing, as it showed wherein errors might easily be made by reason of uneven charging, the escaping flame making it too hot for the charger to do good work. After this "heat" no more metal was charged than the "bed" could well carry, thus permitting all iron to be carefully charged before the blast went on. The plan adopted in these tests was to make at least two casts of each grade, the first being that of the metal in its original state, each grade being broken to uniform size as far as possible. This, in being melted down, was run into molds that gave blocks weighing about 15 pounds each and in size $2\frac{1}{2}$x4x6 inches long. For the second test of each grade these blocks, in the larger "heats," would be broken in two pieces, but where there were only three blocks for each side they would be charged whole. The idea of running the first cast or "heat" of pig metal or scrap into blocks was to obtain metal that would be closely uniform in size and weight, the better to insure like conditions in making a comparative test—an important requisite. This appears in Table 1, in the columns marked alternately "Pig" and "Block."

Up to the time of writing this paper I have made nineteen comparative casts, but only give results of eight of them here, for the reason that in the case of others I desire to make experi-

ments that will involve much time, and that should be compiled with the second series to give completeness to the results in that line of inquiry. As the first series of tests is distinct in showing what effect low silicon and high sulphur has upon the fusibility of iron, as compared with high silicon and low sulphur, with the carbon and iron closely constant, I have permitted the appearance of this paper at the request of our secretary. The purpose is, also, to start other investigations in the same lines, so that when my second paper is ready its subjects can be discussed from the standpoint of regular shop experience or observation. By way of suggestion to any interested in this new line of research, I will outline fields which have so far opened themselves to my mind. What I am giving you in this paper is under the head of "Comparative Fusion Tests of High and Low Silicon and High and Low Sulphur Irons." That which I have outlined so far for my second paper will comprise comparative tests under the following heads. Second series: "Fusion Tests of High and Low Carbon Metals.' Third: "Fusion Tests of Steel and Cast Iron." Fourth: "Fusion Tests of Wrought, Malleable Iron and Cast Metals." Fifth: "Fusion Tests of Ferro-Silicon, Manganese and General Founding Iron." Sixth: "Fusion Tests of Extremes in High and Low Phosphorus Irons." Seventh: "Fusion Tests of Iron, when the Carbon is in a combined form (Chilled or White Iron), or Graphite form (Non-Chilled or Grey Irons), with all the other metalloids constant."

It is to be understood that in making note of shop experience, observations or tests, the physical nature of the metals as well as their chemical composition is to be detailed.

The importance of this work will be the better understood when it is stated that at the present time our enthusiastic and able co-worker, Mr. S. S. Knight, is laying claim to tests proving (the question of the metalloids' influence never being entertained) that soft grades of all iron will melt down faster than hard irons. The contrary has chiefly been my experience, and appears to be the general expression on this question. Still, I hold, as stated in the early part of this paper, that results are often affected by

combination of the metalloids, as well as by the physical character of the iron, and I believe my second paper will bear me out in this assertion. As this paper is carrying me to a greater length than I expected, I will close by presenting the following Tables Nos. 1 and 2, and comments on the character of the irons used. I desire here to thank Dr. R. Moldenke, the able metallurgist of The McConway & Torley Co., malleable iron founders, of Pittsburg, for the valuable assistance he is giving in this work by furnishing metals and complete analysis of any irons I have thought necessary to have analyzed in carrying on these experiments. I also desire to thank Mr. D. K. Smith, chemist of the Alice Furnace, Sharpsville, Pa., for aiding in the work as timekeeper and taking a close record of each "heat."

TABLE No. 1—COMPARATIVE FUSING TESTS OF HIGH AND LOW SILICON AND LOW SULPHUR IRONS.

"Heat" Nos.	1	2	3	4	5	6	7	8
Blast turned on	1:55	1:35	2:13	2:08½	4:21	1:56	1:44	2:26
Harder iron running	1:57	1:39	2:21	2:12½	4:27	2:02¼	1:50	2:32¼
Softer iron running	1:57¾	1:40	2:21⅙	2:13¼	4:28	2:02	1:50½	2:34½
First mold of harder iron filled	1:59	1:42	2:24	2:16	4:31¾	2:06½	2:55	2:37¼
First mold of softer iron filled	2:01	1:43	2:24	2:15½	4:32¾	2:07	2:55½	2:38½
Second mold of harder iron filled	....	1:43	2:26	2:17	4:36	....	2:57	2:40
Second mold of softer iron filled	....	1:44	2:26	2:16½	4:38¼	....	2:58	2:41
Third mold of harder iron filled	....	1:44	2:27¼	2:17⅓	....	....	....	....
Third mold of softer iron filled	....	1:45	2:28	2:17¾	....	....	....	....
Harder iron all down	2:19½	1:49	2:37½	2:18	4:37	2:09½	2:02¾	2:47½
Softer iron all down	2:22	1:50	2:39	2:18¼	4:40	2:11	2:05	2:48½
Form of iron charged	Pig.	Block.	Pig.	Block.	Pig.	Block.	Pig.	Block.
Weight of iron charged each side	150	65	100	54	40	35	64	50
Time of melting	25m.	11m.	16½m.	6m.	13m.	10m.	15m.	15¾m.
First iron to melt	Hard.	Hard.	Hard.	Hard.	Hard.	Soft.	Hard.	Hard.
Time exceeding its mate	45s.	1m.	10s.	45s.	1m.	15s.*	1m30s.	1m45s.
First iron all down	Hard.	Hard.	Hard.	Hard.	Hard.	Hard.	Hard.	Hard.
Time exceeding its mate	2m30s.	1m.	1m30s.	30s.	3m.	1m30s.	2m15s.	1m.

TABLE No. 2—CHEMICAL ANALYSIS.

Analysis Letter.	A.	B.	C.	D.
Total carbon	4.25	4.03	4.15	4.10
Graphite carbon	2.07	1.76	1.94	3.92
Combined carbon	2.18	2.27	2.21	.18
Silicon	.85	.92	.99	2.70
Sulphur	.21	.19	.17	.03
Manganese	.18	.17	.26	.34
Phosphorus	.192	.129	.655	.085
Iron by difference	94.32	94.56	93.77	92.74

Referring to the preceding tables, attention is first called to the analyses. The column under A is that of hard iron in heats Nos. 1 and 2 of Table No. 1. B is that of a white iron used for heats Nos. 3 and 4. C is that of a mottled iron used for heats Nos. 5, 6, 7 and 8; while D is the analysis of a soft iron used as a constant, to present a contrast to all the hard irons, throughout the eight heats. It may be stated that drillings for analysis were all taken from the blocks as they came from the first casts of the original pig or scrap metal.

In all the "heats" the hard iron is seen to have come down first, excepting in one case, which is found in heat No. 6, and that the flow of hard iron ended soonest in all the heats. Thus as far as these tests go they show that hard iron will melt faster than soft. While I desire to reserve for my next paper any comments as to cause and effect in relation to the chemical composition of these irons, I will say that the irons used correspond in their analysis to irons employed in general founding; and whatever my next paper may show as to results, this paper goes to confirm the general impression existing among founders that hard iron will melt more readily than soft grades, in using the terms "hard" and "soft" as they are generally accepted. For all this, I am of the opinion that we can have a combination of the metalloids wherein the softer iron would be the first to melt. Whatever the results found in the varified experience of broad founding, as to the fusibility of metals, it is to be remembered that if we desire accurate knowledge of cause and effect we cannot ignore chemistry in this line any more than we might now think to do so in formulating our mixtures of iron. And I believe the day is coming when we shall consider reliable data upon the comparative fusibility of our irons to be often of as much value as a knowledge of their chemical constituency.

An interesting discussion followed the reading of the paper. Dr. Richard Moldenke contributed the following:

"Long experience with the melting of iron in Siemens-Martin furnaces having given me the impression that hard irons melt faster than soft ones, and knowing this to be the accepted view

among the trade, I was not a little astonished to see claims advanced insisting on the contrary. At the time, I thought it likely to be owing to some radical difference in composition of the irons that were used, and was therefore more than pleased to hear Mr. West advance the idea of making comparative tests to settle the matter definitely. It has remained for him to devise a most excellent system of melting to accomplish this result, and I for one have been much interested in the working of this 'twin shaft cupola,' if I may so call it. It will give us a ready means of comparing the fusibility of the required brands of iron going into our cupola charges. The few words I have to add relate to the melting of iron in the open-hearth furnace, where there is obviously no difficulty due to the rate of melting, since everything charged is supposed to make up a bath of uniform composition.

"I made two experiments, charging simultaneously in each case two pigs of equal weight and shape, one being soft, the other hard. It will be observed that in the open-hearth furnace, filled up with a charge just melting down, these two pigs thrown on top of the white hot metal, and in the full heat of the furnace, could be closely watched with the aid of blue glass spectacles. In the first experiment I was surprised to find the soft pig melting first. It became soft and could be broken up by a bar, behaving much like plumbers' wiping metal when it is just soft enough to be worked. This soft pig when thus crushed down looks like silver, and makes one wish for time and opportunity to study the characteristics of the carbons while in this state. The hard pig, on the contrary, retained its form remarkably well, not disintegrating as the soft one did, the melted portions dropping off like water. Further investigation developed the fact that the soft iron, which melted first, was about 55 points higher in carbon than the hard iron. Mr. West, in his second paper, will go into this question fully, as he is making extended experiments in this line.

"The other trial was with two irons of the same brand, shape and weight, but running in composition, thus:

	Soft.	Hard.
Total carbon	3.66	3.77
Graphite	3.37	.68
Silicon	.75	.44
Manganese	.33	.23
Phosphorus	.126	.140
Sulphur	.02	.02

"These irons, you will notice, differ only in the silicon, and the consequent proportioning of their combined and graphitic carbons. In melting the above pigs of iron under exactly the same conditions, the hard iron went in first. It held its form well, but in melting ran like water, and was melted before the soft iron was half gone. This soft iron melted sluggishly, and did not hold its form while melting as well as the hard iron. It was very interesting, even if trying to the eyes, to observe the whole process, and now that Mr. West has gone into the matter so thoroughly, we will be certainly able to crystalize our ideas and know what we may look for in making up important charges."

Mr. E. A. Kebler, of Matthew Addy & Co., in connection with his remarks on the subject presented some correspondence he had received in 1892 on this subject. A letter from W. S. Unwin, dated Kensington, London, April 12, 1892, is as follows:

"The statement that white iron is more fusible than gray iron has often been made. For instance in Bloxham's 'Metals' ('Text Books of Science'), page 39, we have: 'The larger proportion of metallic iron contained in the gray cast iron causes it to require a higher degree of heat before it begins to exhibit signs of fusion, but it is capable of becoming very liquid, * * * white cast iron, on the other hand, is softened at a rather lower temperature.' Then this is applied to explain the formation of gray iron on page 45: 'The production of white iron, when the supply of fuel is deficient, has been plausibly referred to the lower temperature of the furnace.'

"Now, I doubt this theory, and though I have not a fixed opinion either way, I don't think the evidence for the lower fus-

ing point of white cast iron is satisfactory. I think the statements are very much due to a theory about the infusibility of pure iron (right, no doubt) and a theory that gray iron is a mixture of pure iron and carbon. In fact, gray iron is a complex alloy in which silicon is essential. I cannot find that the temperatures have been directly observed. Truly yours,

"W. C. UNWIN."

Mr. Kebler recalled the statement of Bell that the temperature of molten iron suitable for steel making is about 2,192 degrees F., and in the same connection read a letter from F. W. Clarke, chief chemist of the United States Geological Survey, in which the latter cited the melting points of various metals as given by Le Chatelier, as follows, substituting Fahrenheit for centigrade: White cast iron, 2,075 degrees; gray cast iron, 2,228 degrees; soft steel, 2,687 degrees; half soft steel, 2,651 degrees; hard steel, 2,570 degrees. Highest heat of Bessemer converter, 2,984 degrees F.

After some further discussion, in which Mr. West urged the members to take a hand in experiments along the line suggested, the meeting adjourned. It was decided that no meetings be held in July and August, and that the next meeting be on Monday evening, September 27.

A REVIEW OF THE FOUNDRY LITERATURE OF THE MONTH.

AMERICAN MACHINIST.

In the American Machinist of June 24, C. Vickers illustrates a method of gating small patterns intended for brass molding.

George O. Vair shows a way of casting "live" rolls in chills. These castings are used in large numbers at sawmills for conveying lumber.

F. A. Farnsworth contributes an article on "Machinery Bearings of Aluminum," in which he shows a method of casting these without permitting the air to reach the metal.

IRON AGE.

In a letter to the Iron Age E. J. Jordan, of Boston, Mass., says

"I notice in the Iron Age of June 3 a paper entitled 'Cupola Practice, Melting and Controlling Mixtures of Iron,' by James A. Beckett,* in which he claims that after several years' experience with the Colliau cupola, he can melt with a 72-inch shell lined up to 54 inches, 55 net tons of iron in three hours after the iron starts to run. Now, I have had 27 years' experience in the foundry business and have made mixing and melting iron a study for a number of years; in fact, I have traveled all over this country mixing iron wherever any difficulty may arise. In two years I operated in some of the largest shops in America, but in all my experience I never saw the cupola of those dimensions that would melt 55 tons in three hours. I have used all kinds of cupolas. I hold that the Greiner cupola will melt iron faster than any cupola on the market for the simple reason that by utilizing the gas in the cupola which escapes from the others iron can be melted with 15 to 20 per cent less fuel. The claim is also made

* Paper read before the Convention of the American Foundrymen s Association, at Detroit, and published in the July Journal.

that iron can be melted hot enough to run castings 1 ounce in weight at the rate of 1 to 14. My investigation of such claims has led to the result that the ratio was more apt to be 1 to 8 or 9 than 1 to 14.

"Mr. Beckett holds that iron high in phosphorus will make a softer casting than iron that is low in the same. I must differ with him. I claim that both phosphorus and sulphur make iron white and hard. For fluxing the ash limestone is advocated. Now, beyond question, it is hurtful to iron. It renders the metal hard and brittle, and it carries off too much metal into the slags. Now, if Mr. Beckett were to try fluorspar he would change his mind regarding limestone. Fluorspar I consider the best and the most helpful of fluxes. It reacts strongly upon accretions formed either by too acid or too basic mixtures or by poor fuel."

THE FOUNDRY.

S. J. Rounce offers the following as an economical pattern varnish where the pattern is to be used but a few times:

It costs a good deal to varnish patterns nicely with shellac varnish, and many a pattern that is to be molded only a few times goes into the sand without the formality of varnish, plaguing the molder by springing and absorbing moisture from corners, etc. We have been using a very cheap varnish that fills a very useful place in our pattern room. Take benzine and add to it all the rosin that it can be made to dissolve, when about to use it, turn into the varnish dish, add lamp black for color, and a little japan, about a tablespoonful to a pint, more or less, as you find it needs. It costs very little and makes a good coat, but should have about twenty-four hours to dry. For patterns you wish to finish well, put on one or two coats, rub down and finish with one coat of shellac, and you will find it good and a considerable saving.

The same writer recommends a core compound, of which he says:

From "The Foundry" I got the idea of using raw linseed oil for cores, and found it made a core strong and unaffected by the dampness of the sand, but it was so strong that it could scarcely

be sawed or filed, and if mixed with enough oil to have consistency the cores stuck to the drying plates very badly. In experimenting to find something better, I found a good thing in the following: Equal parts raw linseed oil and the above described saturated solution of rozin in benzine; mix; cut up what sand you want for cores with the mixture, and bake with a hot fire—little danger of burning. This mixture does not stick to the core box even if unvarnished, and makes a core of ample strength, that will not blow, nor gather damp, or deteriorate if it stands in a mold a month. A stock of cores made up at the first of the year will be perfectly good for use at the end of it; they do not spoil by keeping. I am so well satisfied that I would not thank anyone for anything better. It is cheaply and easily made, always ready, quickly and easily used by any one, and makes a core that is "perfection."

IRON MOLDERS' JOURNAL.

"Heptagon" describes the molding of a large pan in loam and illustrates the necessary rigging employed for that kind of work.

In answer to an inquiry for a white metal suitable for making patterns, the following answer is given:

"The white metal ordinarily used for making patterns is what is commonly known as Brittania metal. There are several mixtures that give one form or other of this metal, but in the foundry where only a limited quantity of it is used, it is generally secured from scrap metal dealers. Much of the so-called silverware on the market is nothing but Brittania metal, but in purchasing it you must be careful or the dealer will palm off on you an alloy that is nearly all lead, and that is almost useless for your purpose. The heavier parts of old coffee pots, cruets, etc., are usually of this undesirable description, the lighter parts as a rule being of a better quality and more suitable for your purpose, but its selection is a matter of experience and judgment. An alloy of 80 parts tin, 17 parts antimony and 3 parts copper, will also be found suitable, while an alloy of tin and antimony alone, in varying proportions according to the class of work, of from 9 to 4 of tin to

1 of antimony will also give a white metal that may answer, but the scrap Brittania has both the virtue of cheapness and superiority. But no white metal can be secured that is not liable to break off with continuous rapping. If the patterns are of white metal the gates should be of brass and either securely brazed or rivetted on.

"Don't pour too hot; it is about right for pouring light castings when a dry pine stick used for stirring it smokes on immersion. For heavier castings it should be poured when the surface of the metal preserves a clear, bright appearance when the scum is pushed back."

THE TRADESMAN.

E. H. Putnam, after enumerating the results of a number of tests made to determine the best method of welding cast iron to steel, offers the following directions:

1st. Polish the steel surface.
2d. Paint with sodium silicate.
3d. Dust with 80 per cent powdered ferro-manganese.

A correspondent of the same journal, in answer to an inquiry for a hard varnish, says:

"The best coating for patterns that I have ever known, and have had some ten to fifteen years' experience with, is ordinary good shellac cut in alcohol in the usual proportions, to which is then added all of the dry ground lead which this solution will hold in suspension after repeated stirrings. These repeated stirrings must occur at short intervals after the mixture is first made, as after a time the red lead will settle at the bottom of the vessel and form a hard cake. Apply a coating of this mixture to the pattern, painting over both body of pattern and core prints; let this dry thoroughly and then sandpaper the surface smooth. Give two more coats and afterwards paint the core prints black and you will have a hard coating upon your pattern which is absolutely waterproof and is practically a coating of oxide of lead which will protect the pattern for a long time.

"After being used for two or three weeks in the foundry and then being sandpapered and recoated with this mixture the surface of the coating will become so hard that it will be impossible to scratch it with the thumb nail, and it will almost turn the edge of a keen knife."